NORTEL

Product Brief

Metro Ethernet Routing Switch 8600

Ethernet has emerged as the infrastructure of choice for new service provider deployments as well as for Layer 2 enterprise-wide interconnect. Applications — such as Layer 2 Virtual Private Networks (VPNs) — and IP-based services — such as the triple play of voice, video and Internet access — are driving the often-cited growth in metro and wide area networks today. Ethernet leverages the decades-long investment in LAN-based networking to offer a packet switching technology that is the most cost-effective available today. For enterprises that want to cost-effectively extend LANs at native rates into the MAN and WAN, Ethernet is the answer. For carriers and service providers looking for a fast, reliable and profitable way to eliminate bandwidth bottlenecks in the MAN, Ethernet is the answer.

Metro Ethernet enables point-to-point, point-to-multipoint and any-to-any connection topologies that meet differing service and application requirements.

Nortel's Metro Ethernet Routing Switch 8600 has been a workhorse for enterprises and a reliable profit-maker for service providers. It is leading the way in delivering scalable, feature-rich, Ethernet-based VPNs and next-generation Ethernet MAN infrastructure.

The Metro Ethernet Routing Switch 8600 delivers 100-Megabit, 1- and 10-Gigabit Ethernet interfaces with carrier-class performance, availability and Quality of Service (QoS). Its flexibility, scalability and support for a wide variety of interfaces make it the natural fit for business-critical applications and services.

The Metro Ethernet Routing Switch 8600 delivers important benefits to service providers seeking to increase their Ethernet-based network footprint and to enterprises whose scale of operations leads to carrier-class solutions (Table 1).

Table 1. Metro Ethernet Routing Switch 8600 key benefits

Feature	Benefit
Multiple services (e.g., Internet access, transparent LAN service, VoIP VPNs, etc.) supported per user-network interface (UNI) port	Maximizes revenue generation
Efficient IP Multicast and VLAN-to-IP network mapping capabilities	Allows efficient triple play service delivery on every UNI port
Ethernet access ring resiliency with 50ms protection on the ring	Ensures high availability to meet strict SLAs
A well-defined Ethernet UNI	Provides complete end-user service delineation and controls service parameters
A robust network-to-network interface (NNI), enabling support of up to 16 million Ethernet VPNs	Delivers extraordinary degrees of network and service scalability, security and operational ease
A flexible suite of traffic policing, QoS and statistics capabilities	Enables multiple levels of service at different price points
OAM&P tools supporting end-to-end, per-VPN performance monitoring and measurement capabilities	Provides enhanced SLA monitoring for service assurance
Support for existing and emerging Ethernet-related industry standards	Meets interworking demands of multi-vendor Ethernet switched and transport networks

What makes the Metro Ethernet Routing Switch 8600 exceptional?

In the service provider environment, the principle challenge today is that of cost-effectively delivering multiple services to residential and business end-users as well as wholesale services like wireless backhaul, while leveraging a common, converged infrastructure. Nortel has made this possible with the Metro Ethernet Routing Switch 8600. Nortel's leading-edge Ethernet User-Network-Interface (UNI) offers the following features to support enterprise VPN and triple play revenue-generating services:

- Service demarcation and security
- Scalability and efficiency
- Reliability
- Service turn-up and management
- Quality of Service
- Interoperability

With the capability to deliver hundreds of millions of packets per second (Mpps) performance, the Metro Ethernet Routing Switch 8600 provides these attributes along with carrier-class resiliency on a production-tested and proven solution.

Service demarcation and security

Ethernet traffic may be presented to the operator network using a variety of Ethernet techniques such as IEEE 802.1Q and IEEE 802.1ad (Provider Bridge or Q-in-Q), which allow for efficient scaling of local and access area networks. As traffic ingresses the operator network, customer and service level delineation is achieved with support for IEEE 802.1ah (Provider Backbone Bridge or MAC-in-MAC) encapsulation, which creates a secure, scalable hierarchy of addressing that avoids several pitfalls of traditional LAN-based approaches. The end-user packet is completely encapsulated by a service provider MAC header and assigned a service identifier that is globally unique to that service.

The Ethernet UNI neither uses nor processes Layer 3 address information from the end-user's network. Network address translation is unnecessary, because the entire end-customer packet is encapsulated so that the customer's Layer 3 header is kept intact across the provider network. The use of 802.1ah encapsulation prevents the so-called 'MAC-explosion' problem that could lead to security issues brought about by flooding of customer packets across the provider network. The encapsulation also makes the provider infrastructure transparent to the customer's Ethernet control protocol packets, allowing for efficient interconnection of customer Layer 2 (bridged) or Layer 3 (routed) networks. This approach provides a simple option to tunnel enterprise control frames without interference from the operator (no VLAN or IP addressing coordination is required between the end user and operator).

Unknown unicast, multicast and broadcast traffic are constrained within their respective VPNs, effectively limiting unnecessary broadcasting and the associated inefficient use of bandwidth. In addition, the unknown unicast, multicast and broadcast traffic rates within a VPN can be constrained below set levels as desired by the operator.

The Metro Ethernet Routing Switch 8600 employs state-of-the-art network processor technology to implement Ethernet VPN functions in a programmable format, while retaining the high-speed processing capabilities previously associated with fixed silicon implementations. The ability to program the network processor means that fast-moving changes in standards defining

how VPNs are implemented can be captured and brought to market quickly, and at minimal cost.

Service topologies supported include point-to-point, point-to-multipoint and any-to-any models. Implementation of these specific topologies gives service providers and enterprises additional flexibility while improving overall resource utilization and network efficiency. For example, an enterprise customer with a headquarters site and many branch offices would benefit from an Ethernet VPN service implemented in a point-to-multipoint or hub-and-spoke fashion. Leveraging a point-to-multipoint service topology, service providers can restrict the spokes to only communicate through the hub, thereby maximizing the efficiencies of their Ethernet infrastructure and optimizing resource utilization and enhancing data security.

Metro Ethernet supported access deployment models are:

- Single enterprise service access via a dedicated link
- Multiple enterprise service access via a pre-standard IEEE 802.1ad Ethernet access link
- Multiple enterprise service access via an Ethernet Services Unit access ring

This flexibility makes it appropriate for both greenfield build-outs as well as demand-based expansions to existing infrastructures. These same capabilities limit the number of truck-rolls required to add users and adjust service levels across the network.

Scalability and efficiency

The primary responsibility of the Ethernet UNI is service demarcation, yet the Nortel Ethernet UNI goes beyond simple demarcation by allowing service providers and enterprises to deliver multiple services and service types per port. The UNI encapsulates customer data and adds a unique service label so service providers no longer need to worry about overlapping VLAN-IDs, significantly simplifying operations. The Metro Ethernet Routing Switch 8600 maps customer VLAN IDs to IEEE 802.1ah service identifiers. A transparent UNI is defined when all traffic on a physical port is assigned to a single service ID, while a mapped UNI provides multiple services per physical port to one or more customers. This can be accomplished across thousands of service and customer instances as shown in Table 2.

The Metro Ethernet Routing Switch 8600, when performing the role of a Provider Backbone Bridge, aggregating Provider Bridge traffic that is Q-in-Q tagged, can use either the outer (provider) Q-tag or the combination of inner (customer) and outer (provider) Q-tags for service assignment and classification. This capability gives the service provider superior flexibility for interworking with a wide variety of access devices to support the desired service definitions.

The Metro Ethernet Routing Switch 8600 improves bandwidth efficiency by encapsulating enterprise broadcast traffic inside provider unicast packets. Additionally, the 802.1ah Provider Backbone Bridge implementation uses the MAC addresses of the Ethernet UNIs (ingress ports), rather than customer MACs in the switch forwarding tables. This eliminates the "MAC address explosion" issue by greatly reducing the number of MAC addresses that must be learned and maintained by switches in the service provider's core infrastructure. Keeping the number of MAC addresses to a minimum reduces the aging out and relearning of MAC addresses, thus enhancing end-to-end performance and making network forwarding far more stable.

The Metro Ethernet Routing Switch 8600 delivers high performance, carrier-class Ethernet switching functions for key service provider and large enterprise applications:

- **Broadband managed services to apartments, condominiums, office parks, campuses and more**
- **Carrier-class Ethernet VPNs for seamless LAN/MAN/WAN connectivity**
- **Point-of-presence (PoP) edge-to-core traffic aggregation**
- **Efficient mobile backhaul of 3G/4G traffic**
- **Latency-sensitive and high availability data center applications**

Table 2. Metro Ethernet Routing Switch 8600 scalability

Scalability parameter	Maximum
Unique service identifiers	16,000,000+
Customer VLANs per UNI port	4,000
Provider Bridge VLANs per UNI port	4,000
EVPN service instances per chassis (e.g. E-LINE, E-LAN, E-TREE)	30,000

Determinism and Ethernet

In a carrier environment, the connectionless behavior of traditional Ethernet implies a level of unpredictability that is troublesome in a high availability environment. A recent development in the Ethernet world has been the work on a connection-oriented technique known as Provider Backbone Transport (PBT). PBT builds on the hierarchical nature of PBB (or MAC-in-MAC) by using the backbone address and VLAN tag as identifiers for a deterministic "tunnel" through the network. PBT is being actively worked in the IEEE 802.1Qay committee where it is known as Provider Backbone Bridges – Traffic Engineering.

PBT provides Ethernet with a connection-oriented forwarding mode, which enables dedicated Ethernet links with guaranteed, deterministic performance levels. In this way, PBT delivers QoS over an Ethernet network without the added cost of connection-oriented alternatives. PBT also delivers the following benefits to the service provider:

- **Scalability** — PBT does not rely on the traditional Ethernet MAC address learning methods. This explicit learning approach removes the undesirable MAC flooding behavior that otherwise limits the size of the network.
- **Resiliency** — Since PBT allows creation of point-to-point connections across the network, working and protection routes can be provisioned to provide end-to-end resiliency across arbitrary mesh topologies.
- **Network utilization** — The ability to fully manage traffic paths and know exactly which customer traffic is being carried over which path allows customer SLAs to be met without over-provisioning and under-utilizing network capacity.
- **Manageability** — Since the operations support system (OSS) is aware of the route taken by each service, functions such as alarm correlation, service-fault correlation and service-performance correlation are simplified.
- **Security** — Using point-to-point Ethernet tunnels across the network protects traffic from misconfiguration errors or interception by those with malicious intent. Furthermore, by avoiding the flooding behavior of conventional Ethernet, unintentional leakage of packets to endpoints for which they were not intended can be avoided.

With Provider Backbone Transport (PBT) technology, efficient trunks can be engineered thru the network to deliver end-to-end traffic with deterministic routing and QoS in support of individual multiple-priority services or aggregrated services being backhauled across the MAN. PBT avoids the inefficiencies and lack of carrier-class resilience that otherwise arise from use of the traditional spanning tree algorithm. Rolled out as a software release on the Metro Ethernet Routing Switch 8600, PBT functionality can be deployed as needed, and need not be deployed uniformly across the entire network.

Figure 1 shows the Metro Ethernet Routing Switch 8600 deployed in support of triple play services including video (broadcast TV, video on demand), voice over IP (VoIP) and high-speed Internet access over a common network. Residential subscribers are connected to the network via various access technologies (xDSL, cable, direct fiber, Ethernet access ring, etc.) while enterprise subscribers are connected via direct Ethernet VPNs using the same access infrastructure. A mix of residential and enterprise services are supported on every port, creating a truly shared Ethernet-based infrastructure without compromising on performance.

Triple play services can be further distributed via an Ethernet access ring topology using Nortel Metro Ethernet Services Units. The Metro Ethernet Routing Switch 8600 supports services through other access topologies, such as point-to-point fiber, IEEE 802.1ad access networks and broadband aggregation devices.

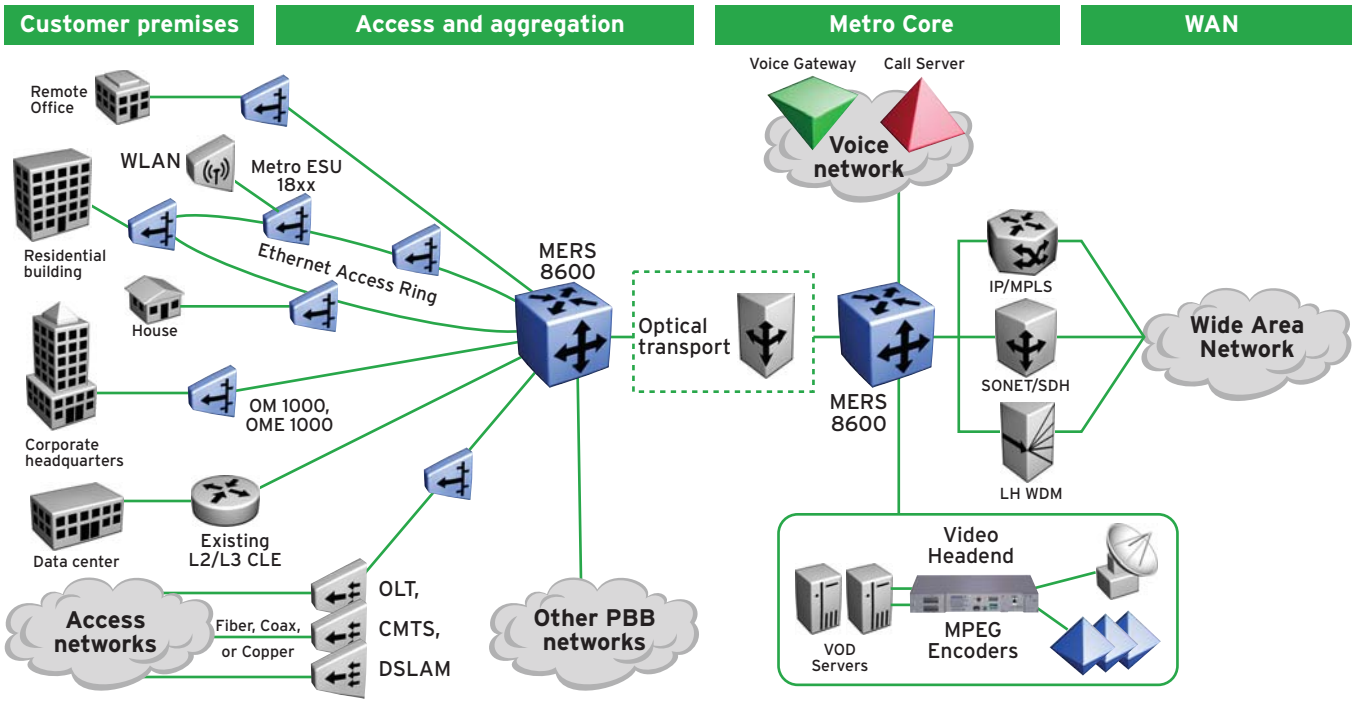


Figure 1. A converged network showing simultaneous delivery of multiple services to varied end users

Reliability

The Metro Ethernet Routing Switch 8600 architecture is designed to provide protection strategies at multiple levels to deliver "five nines" availability.

At the device level, the Metro Ethernet Routing Switch 8600 is equipped with redundant, hot-swappable, components — switch fabrics, control processors, power supplies and fan trays. Temperature sensors constantly monitor the components and cooling systems to maintain acceptable system conditions.

At the trunk level, Distributed Multi-Link Trunking (DMLT) provides redundancy by enabling trunk groups to be configured across different slots in the same chassis. In the event of a failure, links would remain active, because other modules in the trunk group could take over.

Network and link redundancy is provided by several key features:

- 50ms failover when using ring-based access with Metro Ethernet Services Units
- 50ms failover based on LACP MLT between Metro Ethernet Routing Switch 8600s
- 50ms failover based on 802.1ag signaling across PBT tunnels
- Multi-Link Trunking
- Sub-second failover based on RSTP/MSTP protocols (IEEE 802.1w and 802.1s respectively) on NNI trunk ports

Nortel's innovative Split Multi-Link Trunking (SMLT) and PBT capabilities improve the scalability and reliability of Layer 2 networks by removing spanning tree convergence issues and providing faster recovery in the event of link failures

Service management

Service providers require mature network and service management systems that allow quick configuration of the network to support new services as well as quality control of ongoing operations. Since it is important to get the customer's service up and running quickly, and then keep the service running as measured against a service level agreement (SLA), the service provider must have the performance measurements to back up any service-level claims. Additionally, if a fault does occur, the service provider needs the troubleshooting functionality to locate the fault, identify which services have been impacted and react to these appropriately.

Nortel's Metro Ethernet Manager (MEM) is a complete, robust network and service management solution that extends Nortel's key Metro Ethernet innovations such as PBB/PBT technologies while addressing these top-of-mind operational challenges for service providers. Purpose-built to simplify Ethernet operations and facilitate service turn-up, Metro Ethernet Manager employs a consistent work-flow approach to planning and deploying services reliably while minimizing opportunities for configuration mistakes, and allowing quick root cause analysis and recovery when they do occur.

Nortel's Metro Ethernet Manager provides extensive capabilities for performance monitoring, service assurance, SLA measurement and troubleshooting. This advanced management toolkit allows scheduling of periodic tests and generation of a history of the test results to validate VPN endpoints. Tests can include reachability/connectivity (uptime), performance monitoring (e.g., round-trip delay) and failure indications (packet loss). These are critical to measuring and validating customers' SLAs. This capability allows service providers to detect problems with the service before the customer notices the service degradation. These tools also allow the service provider to troubleshoot and isolate any problem quickly and methodically.

This operational simplicity at the service level enables significant operational savings.

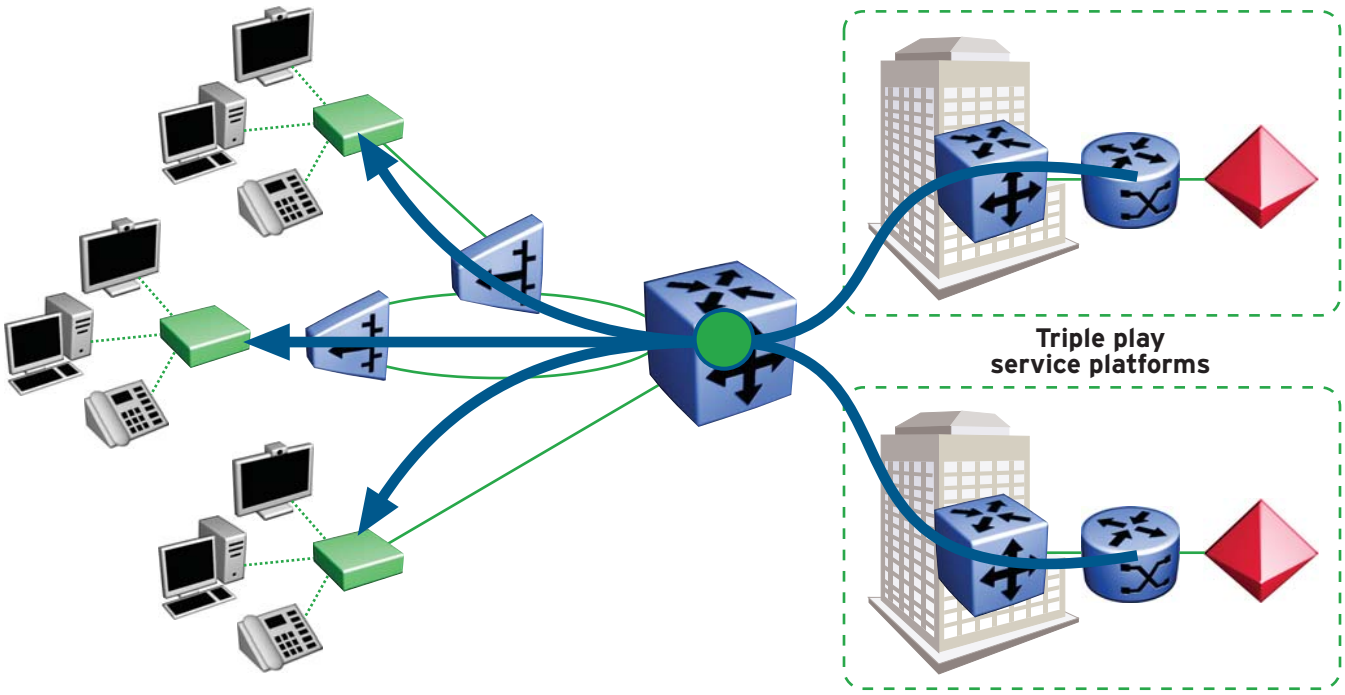
Ethernet for Video Services

Recent trends in access and metro networks indicate that end users, be they business or residential, are using more and more of the network capacity available to them. The root cause for this significant increase in bandwidth usage is almost always attributable to some form of video application.

Such services require that the network support efficient distribution of video content to a large audience across an entire metro or regional area. These traffic patterns drive a hub-and-spoke architecture in which a "hub" node directs the required video streams to the appropriate "spokes." With support for a "Dual Hub E-TREE service" on Metro Ethernet Routing Switch 8600 and Ethernet Services Units (18xx family), Nortel's carrier Ethernet solution provides a high-performance video backhaul transport to end users across the access and aggregation networks to provider hub sites where services are instantiated. With the ability to direct broadcast traffic to only the appropriate network elements as needed, the Metro Ethernet Routing Switch 8600 can connect to more than one hub, and thus provide redundancy or load-balancing. See Figure 2.

Metro ESUs support Internet Group Management Protocol (IGMP) processing and snooping — the de-facto standard for joining and leaving multicast groups. This helps optimize the delivery of broadcast traffic in the access network for maximum network efficiency.

Figure 2. Triple play services implementation



Simple operations

Operators and enterprises alike face unprecedented challenges to control the overall cost of maintaining and operating their rapidly growing networks. Convergence of services onto an Ethernet infrastructure affords a unique opportunity to leverage the low cost of Ethernet infrastructure without sacrificing the carrier-class qualities needed to support the scale and variety of services flowing through the network.

Nortel's Metro Ethernet Manager provides a single interface for all network planning, device configuration and ongoing service management. Tasks such as service provisioning, network state synchronization, backup/restore, software image configuration/delivery, and ongoing fault detection and management are centralized in one operations solution capable of visualizing the entire L0/L1/L2 network.

Benefits to the enterprise or service provider include:

- **Time to service** — With simple, scalable and effective end-to-end service provisioning and agile network configuration. Single endpoint service activation at the Ethernet UNI followed by continuity check verification avoids configuration errors, as well as costly truck rolls.
- **Deterministic service manageability** — Advanced network and service troubleshooting leads to proactive service assurance and rapid failure analysis.
- **Simplified converged operations** — Common and familiar workflows for Ethernet, WDM and SONET/SDH, leveraging operations values of today's operations model.

Metro Ethernet Routing Switch 8600 (8010C) Chassis)

Quality of Service

For enterprises and service providers alike, the network must be able to maintain quality of service profiles and differential service treatment from end to end. Traffic classification occurs at ingress, per-service endpoint, and is done using customer 802.1p or customer TOS/DSCP markings.

The Metro Ethernet Routing Switch 8600 implementation is based on RFC 2698, Two Rate Three Color Marker. This algorithm meters an IP/Ethernet packet stream and marks its packets based on two rates — Peak Information Rate (PIR) and Committed Information Rate (CIR) — and their associated burst sizes, to be green, yellow or red. A packet is marked red if it exceeds the PIR. Otherwise, it is marked either yellow or green depending on whether it exceeds or doesn't exceed the CIR.

The Metro Ethernet Routing Switch 8600 supports four classes of service, with four distinctive queues. Applications are prioritized across the network using intelligent agents in the interface modules to support IEEE 802.1p Class of Service (CoS) and IETF Differentiated Service (DiffServ).

All frames egressing a 802.1ah MAC-in-MAC network are marked with proper 802.1p CoS markings, enabling end-to-end QoS and multi-vendor interoperability. Operators can set policing parameters per port for transparent ports and per-port per VPN for switched (mapped) ports.

Policing

- Ingress policing on a per-port basis for transparent UNI
- Ingress policing on per-service basis for switched UNI
- User-tunable bandwidth in increments of 64 kbps up to 1 Mbps, then to line rate in increments of 1 Mbps
- Committed and Peak Information Rate policing parameters

Ingress packet classification

- Per-port basis
- Configurable mapping of customer 802.1p to service provider priority level per service
- Configurable mapping of customer Type of Service (ToS) field to service provider priority level per service

Interoperability

With its network processor-enabled flexibility, the Metro Ethernet Routing Switch 8600 interworks with a comprehensive range of Ethernet technologies on the user side, including:

- IEEE 802.1Q Ethernet VLANs
- IEEE 802.1ad Ethernet Q-in-Q networks (Provider Bridges)
- HVPLS N-PE

The Metro Ethernet Routing Switch 8600 supports the 8630GBR and the 8683XLR for network-to-network interface (NNI) ports. These modules support 30 ports of 1000BaseX SFPs and 3 ports of 10 Gigabit Ethernet XFPs respectively.

MLT and SMLT are supported for n x 1GE or n x 10 GE load balanced trunks. Egress rate shaping is supported on the 8630GBR and the 8683XLR. Handoff can be either IEEE 802.1ah or 802.1ad format. As an additional security feature, the modules support 1,000 L2-L7 access control list (ACL) filters on ingress and 1,000 on egress per port. ACLs can be configured to provide an additional safety net to ensure that traffic going to other parts of the network conforms to certain rules.

Chassis choices

With a range of fault-tolerant models to choose from, the Metro Ethernet Routing Switch 8600 offers cost-effective Ethernet switching solutions with superior flexibility for enterprises and service providers. Three redundant chassis models are available.

For service provider central offices, Nortel offers a NEBS3-compliant 10-slot chassis designed for the most demanding environments, with enhanced cooling and electromagnetic interference (EMI) protection features.

Where high density, availability and scalability are essential, Nortel offers a 10-slot chassis — one or two slots for a load-sharing CPU/switching fabric module, with the 8 remaining slots available for input/output modules.

Where space is at a premium and lower density is desired, a 6-slot chassis is available.

Module choices

A range of switch modules for access and trunking makes the Metro Ethernet Routing Switch 8600 ideal for the evolving network. Configurations can be mixed and matched to offer Ethernet interfaces from 10 Mbps to 10 Gbps, in conjunction with the Metro Ethernet Services Units or Ethernet switches from Nortel or other manufacturers.

The range of module options means the network can grow as business needs grow. The platform can support scalable switching bandwidth up to 512 Gbps — wire-speed routing of hundreds of millions of packets per second.

This unparalleled flexibility protects the network investment by accommodating evolving Ethernet standards and hard-to-forecast business growth.

Ethernet has emerged as the infrastructure of choice for new service provider deployments as well as for Layer 2 enterprise-wide interconnect.

Ordering information

Order number	Description
Chassis and power supplies	
DS1402001	8010 10 slot chassis. Includes chassis, dual backplane, two fan trays, RS232 cable for management console, rack mount kit and cable guide kit. Requires at least one power supply, up to three power supplies supported.
DS1402002	8006 6 slot chassis. Includes chassis, dual backplane, fan tray, RS232 cable for management console, rack mount kit and cable guide kit. Requires at least one power supply, up to three power supplies supported.
DS1402004	8010co 10 slot NEBS chassis. Includes chassis, fan trays, RS232 cable for management console, rack mount kit and cable management. Requires at least two 8004 power supplies, up to three power supplies supported. Minimum SW ver3.1.2 required.
DS1405011	8005DC 1462W Power Supply. At least one power supply required per 8006, 8010 or 8010co chassis. Cannot mix with 8004 series supplies.
DS1405012	8005AC 100-240 VAC 1140W/1462W Power Supply. At least one power supply required per 8006, 8010 or 8010co chassis. Lower output at 110VAC. Cannot mix with 8004 series supplies. Power cord ordered separately – use AA00200xx series cords.
Software	
DS1410019-4.0	Nortel Metro Ethernet Routing Switch 8600 Software Kit. Includes v4.0 MES SW license, Device Manager and complete documentation set. One license kit required per chassis. Support contracts must be purchased separately.
CPU/Switch Fabrics	
DS1404103	Metro Ethernet Routing Switch 8692omSF Switch Fabric/CPU. One required with R Modules. Operable with pre-E, E and M modules. Includes 256MB SDRAM and 64MB PCMCIA. For use in Metro Ethernet Routing Switch 8600 configuration.
DS1411025	Enhanced CPU Daughter Card (SuperMezz) for 8692SF. Includes dual 1GHz processors. SuperMezz is a mandatory requirement for IPv6 or Sub-100msec failover. Both 8692SF must have the SuperMezz installed; no mixed configurations are supported.
Interface Modules	
DS1404056	8648TXM. 48 port autosensing 10BASE-T/100BASE-TX Ethernet interface module.
DS1404063	8630GBR Routing Switch Module. 30 port SFP GBIC baseboard. The 8630GBR requires the use of the 8692SF.
DS1404068	8668 (Ethernet Services Module). For use in both the PP8000 Metro Ethernet and OM8000 configurations.
DS1404092	8648GTR Routing Switch Module. 48 port autosensing 10BASE-T/100BASE-TX/1000Base-T Ethernet Layer 3 switching interfaces. The 8648GTR is operable with the 8692SF only.
DS1404064	8683XZR 3-port 10GBASE-X Interface Module with XFP slots. Supports both LAN and WAN PHY. Requires 8692SF.
DS1404101	8683XLR 3-port 10GBase-X XFP Routing Switch Module baseboard. Requires 8692SF.

All SFPs, GBICs, MDAs and XFPs sold/ordered separately.

Products are available in 5/6 or 6/6 EUED RoHS compliant models; please contact your Nortel sales representative for the appropriate ordering codes.

Technical specifications

Capacity and performance

- Full duplex switching capacity of 512 Gbps, with load sharing switch fabrics
- Performance for 64-byte packets: Aggregate throughput maximum of 384 Mpps, 10 microseconds latency
- Chassis options: 8006, 6-slot chassis for backbones of lower density or higher space premium; 8010, 10-slot chassis for high availability/high scalability; 8010CO, 10-slot NEBS-compliant chassis. 2 slots reserved for switch fabric, balance for I/O modules

Switch Fabric/CPU modules

One switch fabric required; second optional fabric doubles capacity and provides load sharing

- 8691omSF Switch Fabric/CPU Module
- 8600 CPU Expansion Mezzanine card for 8691omSF. Field Installable. Supports 50ms failover in Metro Ethernet configuration
- 8692omSF Switch Fabric/CPU. One required with 8630GBR and 8683XLR modules. Interoperable with all pre-R modules
- 8692ommez Switch Fabric/CPU 8692 with Expansion Mezzanine card. Supports 50ms failover on NNI trunks with Multi-Link Trunking and PBT

Interface modules

- 8668ESM. 8-port Ethernet Services Module. SFP-based, Gigabit Ethernet
- 8630GBR. 30 ports 1000BaseX for SFP
- 8683XLR. 3 ports 10Gigabit Ethernet XFP – LAN PHY only
- 8683XZR. 3 ports 10Gigabit Ethernet XFP – LAN and WAN PHY
- 8648GTR. 48 ports 10BASE-T/100BASE-TX/1000BASE-T

IP layer protocols

- IPv4
- Routing protocols: RIP, RIP2, BGP4, OSPFv2, IS-IS
- IP Multicast: PIM-SM, IGMPv1, v2, and v3, DVMRP

Address database

- ESM 8668: 98,000 MAC addresses per port
- Addressing: 48-bit MAC address, 32-bit IP address
- Gigabit Ethernet port MTU: 1950 bytes
- Jumbo Frames up to 9600 supported on specific modules

Ethernet protocols and standards compatibility

- IEEE 802.3 Ethernet
- IEEE 802.3z 1000BASE-SX and 1000BASE-LX
- IEEE 802.3ab
- IEEE 802.3ad
- IEEE 802.3ae
- IEEE 802.3x (Flow control)
- IEEE 802.1D Bridging
- IEEE 802.1Q (VLAN tagging)
- IEEE 802.1p (Prioritizing)
- IEEE 802.1ad (Provider Bridge)
- IEEE 802.1ah (Provider Backbone Bridge)
- Provider Backbone Transport (PBT) (pre-standard IEEE 802.1Qay, PBB-TE)
- IEEE 802.1w (RSTP)

Technical specifications — continued

Resiliency features

- Redundant switch fabrics and fans, hot swappable I/O modules, N+1 power supply redundancy
- High Availability Mode = hitless L2 failover; sub-second L3 failover
- IEEE 802.3 ad
- Multi-Link Trunking (MLT) for port level redundancy
- Distributed MLT for trunk level redundancy
- Split MLT for device level redundancy

Quality of Service traffic management

- DiffServ (RFC 2474), IP ToS precedence
- IEEE 802.1Q VLAN Tagging, IEEE 802.1p User Priority settings
- Queues: 8 hardware queues per sub-port; strict priority and WRR configurable

Management and administration

- CLI
- SNMP (v1, v2, v3) compliant management
- Java Device Manager for configuration
- Integrated configuration, provisioning and management via Metro Ethernet Manager

Security

- Filtering: 4096 source/destination or global filter sets, filter actions include forward, drop, mirror, default, reset priority bit
- Internal DOS protection
- SSH and SNMPv3 support
- CLI access protocols; multiple access levels RO/RW password protection; up to six authentication levels supported, SSH, RADIUS log-in and authentication

Physical

8010 10-slot chassis

- Rack space: 13RU, rack-mountable, up to 3 per standard 19", 23" or 600mm wide, 7' high frame
- Dimensions: 22.9" / 58.2 cm high. x 18.5" / 47.0 cm wide x 19.9" / 50.5 cm deep
- Weight: 85 lb. (39 kg) empty, 225 lb. (102 kg) fully configured
- Power: 100 / 240 VAC, -48 / -60 VDC,

8010CO 10-slot chassis

- Rack space: 20 RU, rack-mountable, up to 2 per standard 19", 23", or 600mm wide, 7' high frame
- Dimensions: 35.0" / 88.9 cm high X 17.4v / 44.2 cm wide X 23.7" / 60.2 cm deep
- Weight: 184 lb (83.46 kg) empty, 315 lb (142.88 kg) fully configured
- Power: 100 / 240 VAC, -48 / -60 VDC

8006 6-slot chassis

- Rack space: 9RU, rack-mountable, up to 5 per standard 19", 23" or 600mm wide, 7' high frame
- Dimensions: (H) 15.8" / 40.1 cm high X 17.5" / 44.5 cm wide X 19.9" / 50.5 cm deep
- Weight: 49 lb. (22 kg) empty, 140 lb. (63 kg) fully configured
- Power: 100 / 240 VAC, -48 / -60 VDC

Technical specifications — continued

Environmental

- Operating temperature: 0° C to 40° C (32° F to 104° F)
- 85% - 95% maximum relative humidity, non-condensing
- Operating altitude: 3,000 m (10,000 ft) maximum
- Free fall/drop: ISO 4180-s, NSTA 1A
- Vibration: IEC 68-2-6/34
- Shock/bump: IEC 68-2-27/29

Electromagnetic emmissions

- US: FCC CFR47 Part 15, Subpart B, Class A
- Canada: ICES-003, Issue-2, Class A
- Australia/New Zealand: AS/NZS 3548:1995, Class A
- Japan: VCCI-V3/97.04, Class A
- Taiwan: CNS 13438, Class A
- Europe: EN 55022; EN61000
- Global: CISPR 22; CIRPR24
- CE Mark

Safety agency approvals

- International: IEC 60950
- Europe: EN60950
- IEC/EN 60825-1
- FDA/CDRH CDRH 21(J) CFR 1040.10
- US: UL60950
- Canada: CSA 22.2 No. 60950
- Australia/New Zealand: AS/NZS 3260
- Argentina: S-mark
- Mexico: NOM-019-SCFI-1998

Nortel is a recognized leader in delivering communications capabilities that make the promise of Business Made Simple a reality for our customers. Our next-generation technologies, for both service provider and enterprise networks, support multimedia and business-critical applications. Nortel's technologies are designed to help eliminate today's barriers to efficiency, speed and performance by simplifying networks and connecting people to the information they need, when they need it. Nortel does business in more than 150 countries around the world. For more information, visit Nortel on the Web at **www.nortel.com**. For the latest Nortel news, visit **www.nortel.com/news**.

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